U.S. DEPARTMENT OF COMMERCE
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PB-260 272

REPORT ON THE DELAWARE RIVER BASIN FOR THE PRESIDENT'S WATER RESOURCES POLICY COMMISSION

PUBLIC HEALTH SERVICE, BOSTON, MASSACHUSETTS

MAY 1950

PB 260 272

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U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No. PB-260 272
4. Title and Subtitle Report on the Delaware River Basin for the President's Water Resources Policy Commission			5. Report Date May 50 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Public Health Service, Boston, Mass. Northeast Drainage Basins Office.			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered 14.

15. Supplementary Notes

Portions of this document are not fully legible.

16. Abstracts

A report on the Delaware River Basin (New York, New Jersey, Pennsylvania, and Delaware) prepared by the North Atlantic Drainage Basins Office, Division of Water Pollution Control, Federal Security Agency, Public Health Service, for the President's Water Resources Policy Commission. Physical and economic data for the basin are presented, the benefits to be derived from pollution control are described, and specific policy problems are discussed.

17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

Delaware River Basin
Water pollution control
State programs
Water resources
Industrial wastes
Sewage treatment
Water supply

17c. COSATI Field/Group 13B

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 26
	20. Security Class (This Page) UNCLASSIFIED	22. Price

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

REPORT ON

THE DELAWARE RIVER BASIN

for the

PRESIDENT'S WATER RESOURCES POLICY COMMISSION

Prepared by the

North Atlantic Drainage Basins Office
Division of Water Pollution Control

Federal Security Agency
Public Health Service
May 1950

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THE DELAWARE RIVER BASIN

Introductory Resume

No major watershed in the United States is more useful and valuable, either now or potentially, than the Delaware. More than 5,000,000 people live within the Basin itself and more than 10,000,000 live outside of the Basin within two hours driving time. A substantial portion of the latter are dependent for their future existence on the waters of the Upper Delaware. Mining and manufacturing activities engage 700,000 people or 15% of those living in the Delaware Basin. They produce products valued at 3 billion dollars annually. The future economic welfare of these industries depends largely on the availability of good cheap water. Many new production methods require large quantities of high quality water, and it is essential that this be provided.

It is not surprising that interstate conflicts have developed in an area of this kind. The necessity of resolving these conflicts has resulted in the establishment of the Interstate Commission on the Delaware River Basin (INCODEL). This Commission has no enforcement powers but operates through the development of reciprocal legislation among the specific states. It has been a potent force in resolving water resource conflicts and has pioneered in an important area of interstate cooperation. The current water resource study gives promise of bringing the solution to water problems on a long range basis.

Through the efforts of INCODEL and the cooperating State water pollution control agencies, the Delaware Basin has been divided into four different zones. Reciprocal legislation specifies the degree of treatment required for municipal and industrial effluents discharged into waters in the respective zones. Substantial progress has been made in pollution control through this mechanism, together with energetic programs of the State agencies. Most municipalities and institutions located on smaller tributary streams have installed treatment works although some of these are in need of enlargement and improvement at the present time. Installation of treatment works has lagged along the main river and those streams carrying acid mine discharges. Currently, however, some $80,000,000 worth of municipal pollution control works is underway, most of which are located along the main streams.

Further reinforcement of pollution control activities is seen through the enactment last year of comprehensive water pollution control legislation in the States of New York and Delaware.

Proposed programs are comprehensive in nature looking towards the preservation of the waters for all uses. Consideration is given to stream flow regulation, flood control, pollution control, salinity control in the area below Philadelphia, protection of oyster and fishing resources, recreation, power production, and navigation. All of these uses are important in various areas. Encouragement towards proceeding on the existing pattern is strongly recommended. Major water supply projects must be planned and constructed far in advance of actual needs. If the States should fail to demonstrate their ability to proceed by cooperative action, higher authority must be resorted to in order to protect and preserve the economy of this vital area of the country.

THE DELAWARE RIVER BASIN

PART I

PHYSICAL AND ECONOMIC DATA

Description of the Basin

Rising on the western slopes of the Catskill Mountains in the State of New York, the Delaware River flows in a southwesterly direction as the East and West Branches to their confluence at Hancock, New York. From Hancock, the river flows southward 326 miles to the sea as a boundry water, first dividing New York and Pennsylvania, then New Jersey and Pennsylvania, and finally New Jersey and Delaware. The lower Delaware River has been developed as a navigable waterway to the head of tidewater at Trenton, New Jersey. The river drains an area of approximately 12,750 square miles in Pennsylvania, New Jersey, New York and Delaware.

Within the area of the four states which comprise the Delaware River Basin there are 838 separately incorporated political subdivisions. These consist of 38 counties, 24 cities, 299 boroughs or villages and 477 townships or towns. Approximately three-fourths of the inhabitants of the Delaware River Basin reside in urban communities, having a population greater than 2,500. More than 50% of the basin population can be found in the Philadelphia-Camden area. The total population of the basin is now estimated at close to 5,000,000 people.

In the upper Delaware Basin, above Trenton, lies an area more than three-fifths forested with approximately 25% of the population. Below Trenton is massed over three-fourths of the population of the watershed, densely urbanized and highly industrialized. The upper Basin including the main stream, its tributaries and a large number of natural lakes is an area of great scenic beauty and charm. Recreation is its major industry, now and for the future. Well developed and widely diversified manufacturing industries in the lower Delaware Basin, advantageously located with reference to transportation and distribution centers, reach their heaviest point of concentration in the Philadelphia-Camden metropolitan area and continue downstream to the Delaware Bay. In the latter area, commercial fisheries and oyster beds are predominant.

The tidal river between Trenton and the sea is highly developed for navigation, having channel depths varying between 25 and 40 feet. Here are located the port facilities which make the "Port of the Delaware River" the second largest in the United States and the largest fresh water port in the world.

The anthracite coal fields in the upper Lehigh and Schuylkill drainage basins and the cement production of the Allentown-Bethlehem-Easton area are the most important mineral resources of the Delaware Basin. From Trenton, New Jersey, to Wilmington, Delaware, has developed one of the most industrialized river sections in the country. The industrial activity ranges from shipbuilding and oil refinery to clothing manufacturing.

There are approximately 50 stream gaging stations in the basin. At Trenton, the flow in 1946 ranged from a maximum of 82,300 c.f.s. to a minimum of 2,190 c.f.s., with a 33 year average of 11,710 c.f.s. The recorded extreme flows at Trenton are maximum 227,000 c.f.s. and minimum of 1220 c.f.s.

There have been no floods of consequence on the Delaware but the Lehigh, Schuylkill and Lackawaxen Rivers have been subjected to severe floods.

In general the quality of the headwaters of the Delaware is soft and makes an ideal source of water for domestic use. The water of the Schuylkill tends to be hard limiting its industrial uses. The head waters of the Lehigh River has been proposed for development as a future water supply for Philadelphia.

Precipitation over the basin is fairly uniform. The general average ranges from 40 to 50 inches annually. About six per cent of the area has less than 40 inches rainfall. Over a century of record at Philadelphia, the rate of precipitation in August, the month of maximum precipitation, is only 126 per cent of the average for the year while the rate for the month of least rainfall is approximately 90 per cent of the mean annual.

The Delaware River and its tributaries, in flowing through and adjacent to some of the most highly industrialized and urbanized portions of the country have had unusual demands placed on its flow of water. The future holds little promise for any respite and it has been estimated that by 1980 two billion gallons of water daily may be required from the Delaware and its tributaries to meet the domestic demands of the people of New York, New Jersey and Pennsylvania. This water demand will be met principally from headwater reservoir developments.

Diversion of Delaware waters has been before the U.S. Supreme Court in the celebrated Delaware River Diversion Case of 1931. At that time the Court decided that New York City could divert water up to 440 m.g.d. and established conditions under which the diversion could be made including a rule for the release of compensating water for the augmentation of dry weather flows. A multiple reservoir system has been proposed that will provide adequate storage for both domestic water supply and low flow control. It has been estimated that releases from the storage reservoirs will maintain a low flow of 4000 c.f.s. at Trenton whereas the present minimum low flow is approximately 1240 c.f.s.

Sources of Pollution

The Delaware River and its tributaries receives the waste discharged from 265 municipalities and 975 significant industrial plants. The extent of the pollution is indicated in the following table:

Source	Amount of Pollution Contributed: Number	Estimated No. of People Served c/	Pop. Equivalent of Wastes Discharged to Watercourse d/
Municipalities a/	265	3,951,000	2,492,000
Industrial Plants b/	975	---	4,767,000*
Total	1240	3,951,000	7,259,000

* The Population Equivalent of wastes discharged from industrial plants includes an estimated Population Equivalent of 3,000,000 from industrial establishments in Pennsylvania.

a/ Includes incorporated or unincorporated municipalities, other legal bodies as sanitary district, counties, towns, significant institutions, resorts, recreational centers or other population centers. (This pollution includes the industrial wastes discharged into municipal sewerage systems.)

b/ Industries discharging wastes directly to water course.

c/ Latest estimated population.

d/ In reducing to a common basis certain wastes from industries and municipalities, it is common practice to express the non-similar wastes in terms of a common unit, Population Equivalent. (B.O.D. calculated at 0.167 lbs. per capita per day).

Domestic and industrial wastes discharged to the Delaware River and its tributaries are equivalent to the raw sewage discharges from about 7,300,000 persons. The pollution load is further increased by the discharge of oil, silt and discoloring materials. About two-thirds is contributed by industries in the basin. The wastes are of great variety and consist of sewage with its health hazard, other highly putrescible organic wastes, toxic and odor producing substances, dye, oils and silt. Among the many and diversified types of establishments discharging wastes are steel mills and metallurgical establishments, metal working plants, gas works, distilleries, pulp and paper mills, chemical, by-product coke works, mines and quarries, milk plants and food processing and canning plants.

It is estimated that more than 60% of the pollution load is discharged in the Philadelphia-Camden metropolitan area where the Delaware River is grossly polluted; and the Schuylkill River is

greatly overloaded with domestic and industrial pollution. Other significant areas of pollution along the Delaware are at Port Jervis, the Easton-Phillipsburg Area, and Wilmington.

Untreated sewage and industrial wastes reaches the Schuylkill River from communities in its upper section above Reading. From Reading downstream practically all the municipalities provide primary treatment of sewage and are proceeding with plans for secondary treatment. Considerable industrial waste is discharged to the Schuylkill. Approximately 40 million tons of silt from coal operations deposited in the Schuylkill during the past 100 years, at places with a depth of 26 feet, is being removed in a Schuylkill River Clean-up Project and desilting facilities have been installed at 47 active coal washeries.

Pollution of the streams has impaired their use for drinking water supplies, industrial water supply, and recreational purposes.

The City of Chester is now developing a water supply project on Octoraro Creek to ultimately supply 30 m.g.d., and will abandon the Delaware River as a raw water supply because of its gross pollution.

To supply necessary water for industrial plants during the war it was necessary to drill additional wells and increase the use of ground water. Approximately 125 m.g.d. is pumped from wells in the Philadelphia-Camden metropolitan area. Ground water is used at the Philadelphia Naval Base for potable as well as industrial supply and with continued use is getting worse in quality, probably by recharge of the underground supply with polluted water from the rivers and contamination from other sources.

The extensive truck farming in the State of Delaware has had a parallel development in an extensive canning industry. This industry has waste discharges very high in organic matter and the relatively small streams of the coastal plain are usually unable to assimilate this heavy load. Poultry processing plants present another critical problem in this State.

The Schuylkill and Lehigh Rivers receive acid mine drainage from the anthracite coal mines. The coal washings and discharges of sewage and industrial wastes have so badly polluted the Schuylkill River that recently the State of Pennsylvania has instituted a complete clean-up of this stream. This has involved the removal of silt from waste waters discharged from coal washeries, adequate treatment of sewage, and industrial waste discharges, and a dredging program to restore the channel of this stream.

The Delaware River has always been famous for two particular forms of wildlife, the oysters of the lower bay region and the famous shad runs of the spring. In the case of the former it has been very important to the oysterman that adequate fresh water flow of the river be continued through all seasons without upstream restriction. The shad fishery in the Delaware River was very extensive as far up as Port Jervis, but is now confined largely to the lower reaches of the river and the bay below Pennsville. In 1947 the Fish and Wildlife Service made an extensive survey of the region to determine just what restricted the shad in their seasonal migration up the Delaware River. Their results indicated that there was actually only one water characteristic which deviated significantly from the standards of water acceptability for fish life. It was that of low concentrations of dissolved oxygen. There was no specific substance in excess which could cause lethal conditions except perhaps ammonia. They concluded that these waters, if well-aerated, would support fishlife. A barrier of oxygen-deficient water which would limit the migration of the shad either up or downstream, was found to extend to some 35 to 40 miles in length. This zone had less than 2 parts per million of dissolved oxygen. Shad were found to be killed in oxygen concentrations of less than 4.5 p.p.m.

Water Use and Adequacy of Water for Indicated Uses

The waters of the Delaware River and its tributary streams have become one of the most coveted sources of water in the Eastern United States. More than 2,600,000 people are supplied with water taken from the Delaware and its tributaries. For the past 30 years the metropolitan regions of New York, northeastern New Jersey, and Philadelphia, containing about 1/8 of the total population of the United States, have been almost constantly confronted with water supply problems. Since 1920 these water supply problems have been subjected to study by a variety of official boards and commissions. Headwater streams of the Delaware in the New York drainage area are now being developed as a watershed for New York City, and impoundments and tunnels are being rushed to completion to help alleviate the present shortage of water in the Metropolitan New York area. Planning is in progress to further develop this area and increase its potential as a watershed. At present the Philadelphia area is using both the Delaware and Schuylkill Rivers as water sources. Because of the heavy pollution in these streams and inadequate supply during low flows, future demands may dictate the development of new sources.

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Need for Treatment Works

The status of existing sewage and industrial waste treatment works and the need for new treatment works and improvements in the Delaware River Basin is shown in the following table:

Sewage and Industrial Waste Treatment Plant Requirements

Source (1)	Total No. (2)	Without Treatment			With Treatment			No Project Req'd (9)	No Data (10)
		No. (3)	Treatment Needed (4)	Status Unknown (5)	No. (6)	Improvements Req'd (7)	Status Unknown (8)		
Municipalities	265	100	98	2	165	76	-	89	-
Industrial Plants	975	834	392	442	141	21	2	118	-
Total	1240	934	490	444	306	97	2	207	-

Sewage treatment facilities are provided in 62% of the municipalities or institutions but these do not include the principal sources of the pollution load which enters the streams in the Philadelphia-Camden metropolitan area. Forty-six (46) percent of the existing sewage treatment plants need improvement.

In the Philadelphia-Camden metropolitan area considerable progress is being made in sewage treatment projects. The City of Philadelphia is actively proceeding with construction of three sewage treatment projects estimated to cost $60,000,000, including interceptors. The new Northeast Works will be placed in operation this summer. Construction of the pump station and portions of the interceptor have been completed for the Southwest plant, which is designed for a flow of 140 m.g.d. Work has begun at the site of the Southeast works designed for a flow of 133 m.g.d. These projects are to be completed by the end of 1953 or early in 1954. About the same time it is expected that four Authorities serving the densely populated area in Pennsylvania downstream from Philadelphia will have constructed sewage treatment works.

The City of Camden, New Jersey, is proceeding with a 3 year sewage treatment program which will cost $17,000,000. Construction of interceptors under a $3,000,000 contract is underway and sites have been acquired for 2 sewage treatment plants. The Northeast plant is to be in operation by the end of 1951 and the main plant by the end of 1955.

Progress in sewage treatment is also being made in other areas such as the Cities of Gloucester and Phillipsburg, New Jersey, where contracts have been awarded for construction. The borough of Norristown, Pennsylvania, has awarded a contract for additions to its existing treatment works, and bids have been taken by Conshohocken, Hamburg, Shoemakersville, Schuylkill Haven and by the City of Reading. Bethlehem and Easton have completed plans for sewage treatment works and are under construction orders. Four authorities in Delaware County, Pennsylvania, downstream from Philadelphia, have been issued permits approving plans for sewage treatment works and will be issued construction orders as the Delaware clean-up program progresses.

The City of Port Jervis, New York, with a population of approximately 10,000 recently advertised for bids for sewage treatment facilities which will also treat acceptable industrial wastes, and received a low bid of $1,880,000.

In the upper Schuylkill River area sewage is discharged untreated from practically all the municipalities which are now under orders to provide primary treatment. From the City of Reading, downstream to Philadelphia, the municipalities now provide primary treatment and are required to install secondary treatment.

Pennsylvania is notifying all municipalities and polluting industries in the Delaware Basin including the Schuylkill River drainage area to undertake construction to be completed within approximately two years.

Industrial wastes are reaching the Delaware River and its tributaries from an estimated 1240 sources. These wastes have an estimated population equivalent of 5,000,000. Treatment facilities are provided at 306 establishments, 97 of which require improvements. Untreated industrial wastes are discharged from 934 sources of which 490 need treatment works and the remainder require further investigation. Many of the existing industrial waste discharges in the Philadelphia-Camden Metropolitan area will no doubt be discharged into the municipal systems.

In the State Health Department, Philadelphia district orders have been issued to 250 industrial polluters to abate or treat their waste waters before discharge. Approximately 108 of these represent

90% of the pollution load. Since 1944 approximately 35 industries in this area have spent $25,000,000 in construction of treatment works and 50 additional industries have spent approximately $1,220,000 in independent action to abate pollution or provide treatment facilities. It is estimated an additional $25,000,000 will be required to provide industrial waste treatment works to complete the program in this area.

Progress is being made to correct the oil pollution resulting from the discharge of wastes from the refineries in southeastern Pennsylvania. The refineries have a $7,000,000 pollution control program of which $4,000,000 in construction is underway.

The Schuylkill River clean-up project involves the removal of silt and culm from the stream channel and adequate treatment of sewage and industrial wastes before discharge to the stream. In the stream desilting project the State of Pennsylvania is removing the silt from some 125 miles of stream from the headwaters to Norristown, at a cost of $35,000,000. It is expected that by this summer (1950) the Federal requirement of removing one-half the silt present in the River will be met, at which time the Army Engineers will resume dredging below Norristown at a cost of probably an additional $20,000,000. All 47 operating collieries on the headwaters have installed desilting basins which are removing thousands of tons of coal which otherwise would be discharged to the stream. Surveys made on a comparable basis showed the reduction in the silt burden carried by the Schuylkill River, including culm eroded from river banks as follows:

November	1947	350,000 tons per month
May	1949	7,000 tons per month

It is estimated that the pollution control program in the Delaware River Basin will cost $220,000,000 with $110,000,000 required for sewage treatment works and facilities, $53,000,000 for industrial waste treatment works and $57,000,000 for desilting work in the Schuylkill River Basin.

PART II

BENEFITS AND COSTS

Benefits to be Derived from Pollution Control

Benefits to be derived from pollution control of the Delaware River Basin need no detailed justification. The very existence of the 15,000,000 people in the Delaware Basin and adjacent thereto depends in large part to the wise development and use of the waters of this river. Money spent for water buys more benefits to the public than money spent for any other commodity. It is therefore imperative to protect the quality and provide the quantity necessary to support the population concentrations and the industrial economy that provides their livelihood. There is greater realization in the Delaware Basin at present than at any time in the past of the necessity for this. Experience has taught industry and municipality alike that water is a commodity of tremendous value that cannot be abused indefinitely without dire consequences.

A substantial portion of the estimated cost to the State of Pennsylvania for the restoration of the Schuylkill ($35,000,000) will be repaid through the sale of culm recoveries. It has been estimated that municipal water supplies along the Schuylkill have in the past required as much as 8 times as much alum for treatment than is necessary at water works of similar capacity taking water of high quality. In addition to the economics of the situation, there is a concomitant health hazard that cannot be measured in any tangible terms.

Proposed projects will provide for the maximum utilization of the waters of the Basin. Flood peaks will be reduced and waters formerly wasted will be conserved for use as municipal water supplies, for augmenting low flows during dry seasons, for increasing the assimilatory capacity of the stream to receive residual pollution, and for preventing the saline front from encroaching in the lower Philadelphia area with the resultant damage to industrial and municipal water supplies in that area.

PART III

SPECIFIC POLICY PROBLEMS

The Interstate Commission on the Delaware River Basin (INCODEL) was established in 1936 by reciprocal legislation in the States of Delaware, New Jersey, New York, and Pennsylvania. It is an agency of the cooperating states financed from appropriations by those states. Its objective is the formulation and execution of a coordinated unified plan for the wise use, development and control of the natural resources of the Delaware River Basin as a whole.

As an example of the application of overall planning the Delaware River Basin has been divided into four zones or geographical divisions to serve as the basis for an interstate plan of pollution abatement and control. In establishing these zones consideration was given to population characterisitcs, present use of land and water resources, and aesthetic and economic conditions. Minimum standards for purity of effluents discharged have been established for the various zones and the States have agreed to act in unison toward complying with these standards and proceeding with this program with a view of controlling pollution so that the Delaware and its tributaries may be restored to a quality commensurate with its uses.

Another notable example of its work is the Delaware River Basin Tri-State Water Project Survey of municipal water supply requirements. For years the Delaware River Basin has been the scene of conflict between upstream and downstream interests. The use of w ater resources for municipal water supplies, canals, and hydroelectric developments have been contested by the States of New Jersey, New York, and Pennsylvania, the most noted case being the Delaware Diversion Case in which the U.S. Supreme Court rendered a decision authorizing the State and City of New York to divert 440 million gallons of water per day, for the water supply of the City of New York.

To protect the water in the Delaware for its highest use - municipal water supply - and remove the stumbling block against further diversions caused by the inability of the States and municipalities to reach amicable agreements in the matter, INCODEL recommended a joint study of the problem by the States of New Jersey, New York, and Pennsylvania. This recommendation met with approval and the necessary legislation was passed with appropriations of $200,000 for the survey. INCODEL was designated to conduct the survey to determine the feasibility and advisability of the future construction of an integrated water supply project within the

Delaware River Basin above Trenton, New Jersey, to meet the water supply requirements of political subdivisions in the three states, both within and outside the watershed. The preliminary survey has been completed and a report rendered by the consulting engineering firms retained by INCODEL for this work. This report states that water resources of the Upper Delaware Basin are such that 2,000 million gallons per day can be developed which is sufficient to satisfy all foreseeable water needs for the next 50 years for public water supplies in the New York and Philadelphia Metropolitan Areas. In addition, by regulating stream flow, a minimum of 4,000 second feet discharge can be provided at Trenton. This will serve to dilute residual pollution discharges and prevent salt water intrusion in the Philadelphia area.

The report recommends the establishment of a Delaware River Water Commission, an interstate agency with authority to plan, finance, construct and operate the project. In the interim the report recommends that INCODEL be given the authority and funds to advance plans for construction and financing. This project is a real step forward in the resolution of the conflict existing between the States, regarding the equitable use of the water resources of an interstate stream and will establish a new pattern for interstate water resource development.

The headwaters are used for many recreational purposes. Fishing, swimming, and boating are of great importance to the Basin, as large numbers of tourists and vacationists visit the area annually. However, use for public water supplies has priority but through proper planning the possibility of conflict between opposing interests will be largely avoided. State agencies and INCODEL are aware of the problems and feel that with proper planning no single interest will be materially affected by other uses.

Multiple use is recognized in flood control projects in Pennsylvania. It is contemplated that the areas bordering the proposed impoundments will be used for recreational purposes, public parks, picnic areas, and the conservation pools will be stocked with suitable species of fish.

The commercial fishing interests feel that locations of dams on the main stem of the Delaware River will affect the return of the shad run. The Middle Atlantic Section of the Atlantic States Marine Fisheries Commission has taken this up with INCODEL asking that in its study of possible sources of water supply that it consider the location of dams across tributaries rather than across the main stem.

Sediment problems have occurred on the Schuylkill and Lehigh Rivers. The State of Pennsylvania is now carrying out the Schuylkill River Restoration Project. The pollution from culm and silt has choked the stream to the extent that serious flooding has resulted.

Basic hydrologic data for pollution control activities is reasonably adequate for the basin as many investigations and surveys have been made by Federal, State and municipal agencies. This should not be interpreted to mean that hydrologic data is adequate for comprehensive water resource development. Detailed information on pollution problems in many instances is inadequate but it is believed that this will improve with investigations now underway by the State pollution control agencies and INCODEL.

Local participation in the basin is good and there are many local associations that ably assist in matters of interest to the basin. Some of these are the following: Brandywine Valley Association, Schuylkill River Restoration Association, Delaware River Restoration Association, Route 97 Council, Lehigh Valley Flood Control Council, and many local Chambers of Commerce.

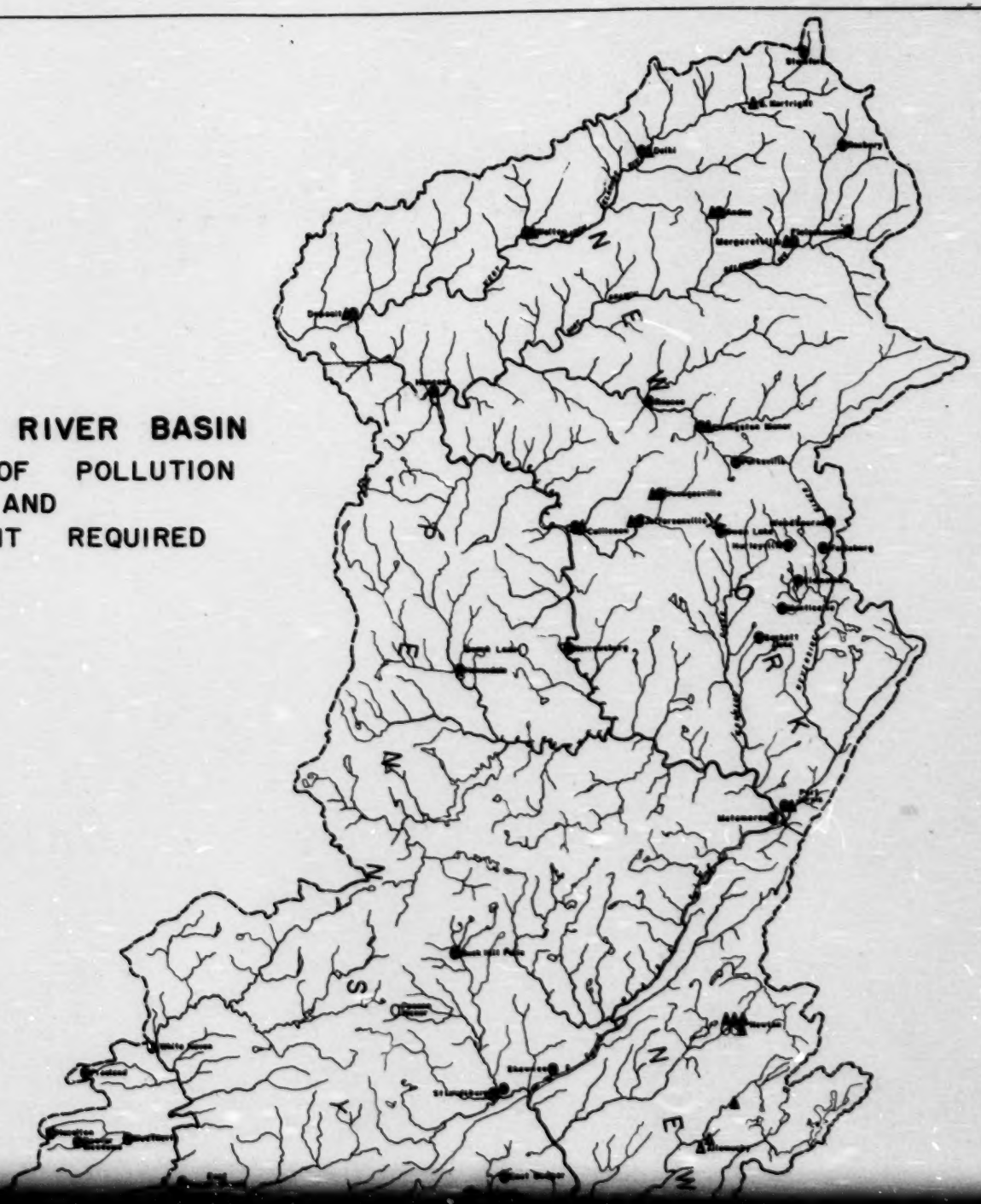
The Brandywine Valley Association has a conservation program that could well be studied as a pattern for wider application. It has a budget for this year of approximately $40,000 obtained entirely through donations. Three full-time professional personnel devote their energies to educational programs designed to awaken the public to the needs of the valley. Illustrated lectures and educational pamphlets are used to good advantage in schools, community groups, civic clubs, and the like. INCODEL is encouraging the establishment of other similar associations.

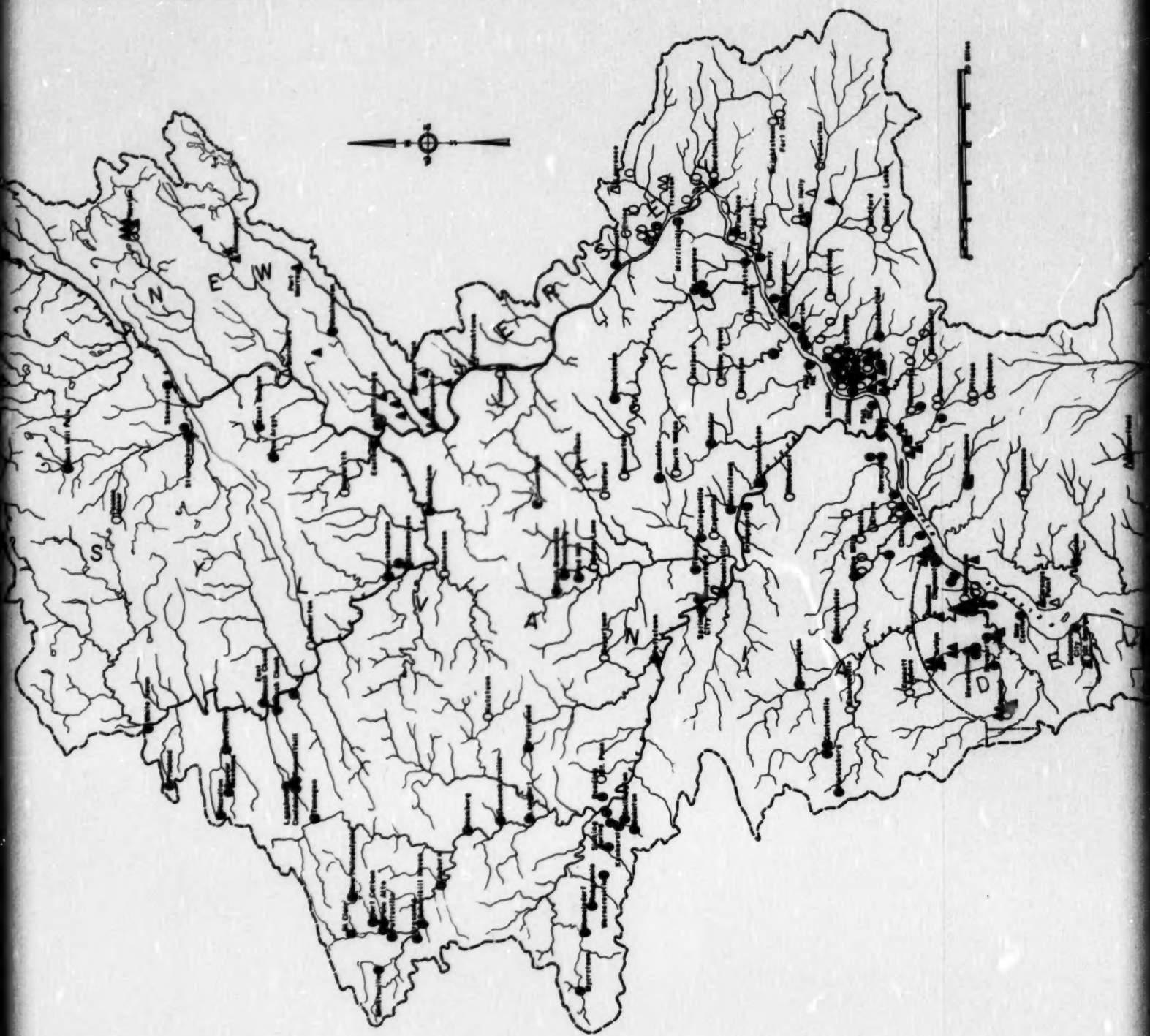
Financing municipal treatment works poses a problem but is not impeding significant progress. Legislation is adequate to permit municipalities to proceed with financing except for New York where constitutional debt limitations pose a problem. This obstacle is receiving consideration by the appropriate legislative committees.

Industry reactions to equitable pollution control measures is generally favorable.

DELAWARE RIVER BASIN

SOURCES OF POLLUTION AND TREATMENT REQUIRED

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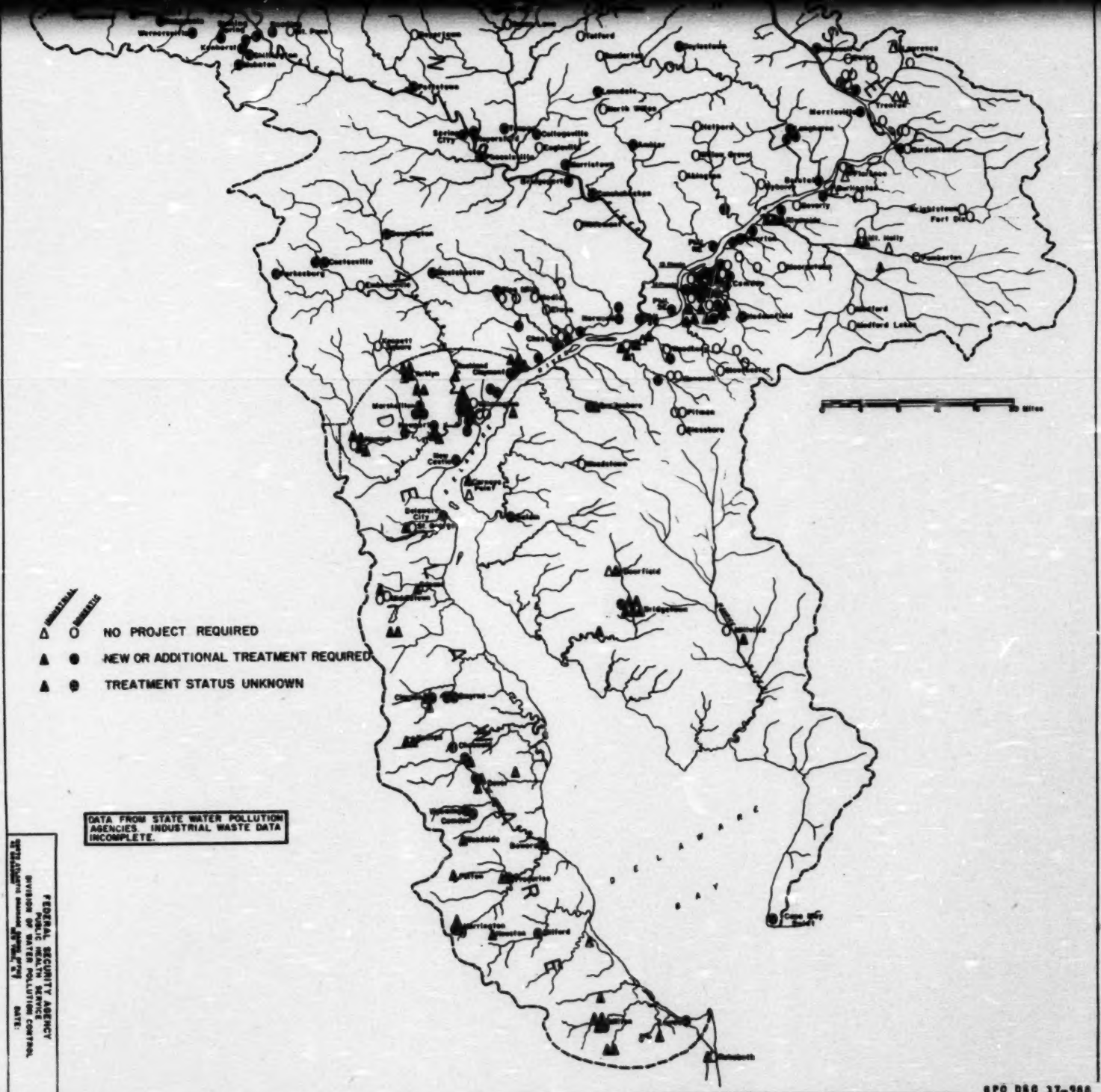
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DIVISION OF WATER POLLUTION CONTROL
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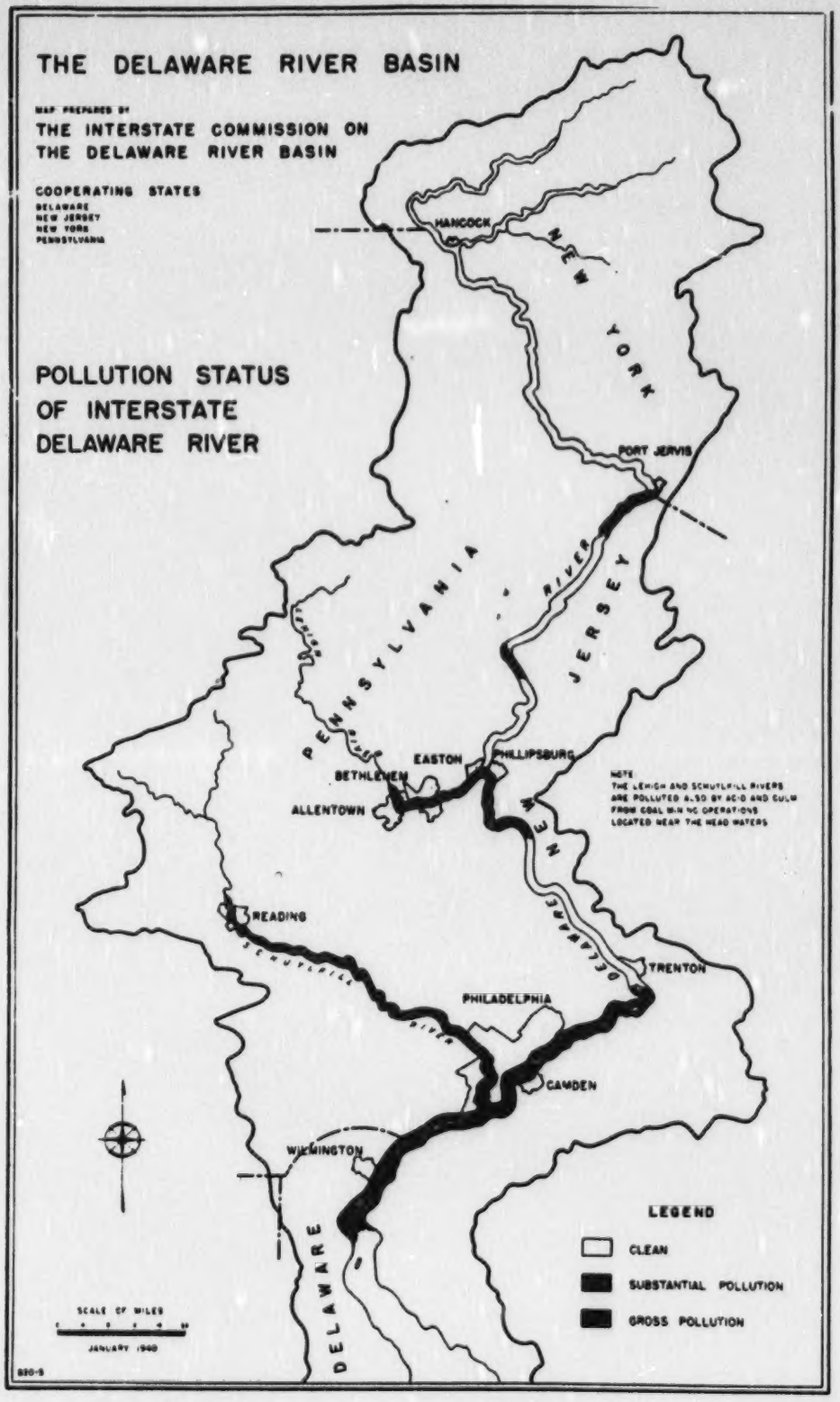
THE DELAWARE RIVER BASIN
MAP PREPARED BY
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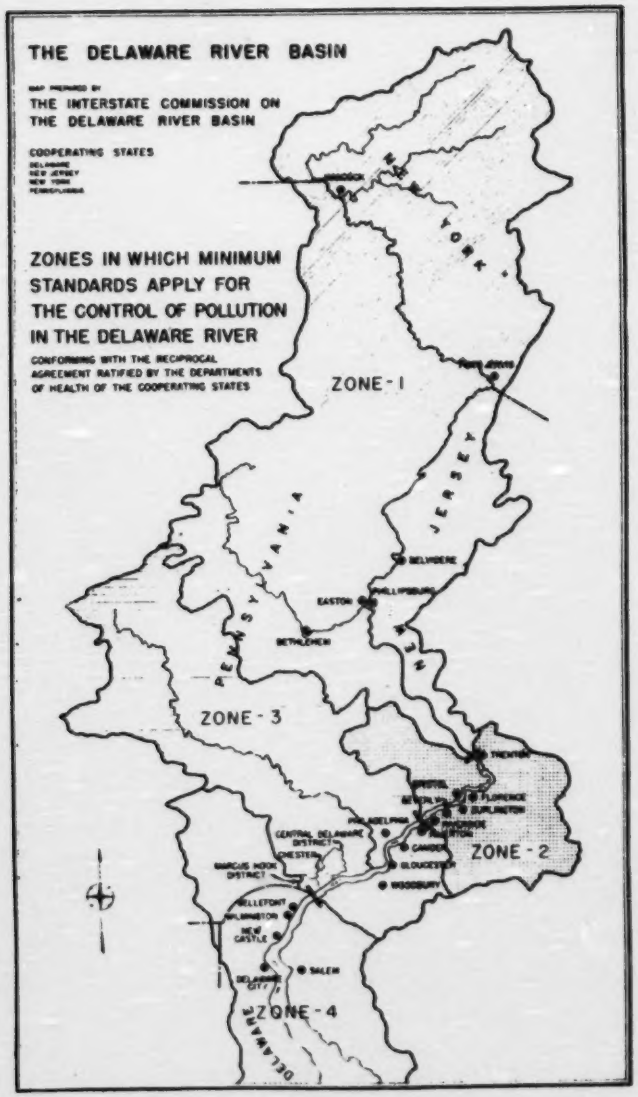

ZONE 1: Zone 1 is that part of the Delaware River and its West Branch extending from the New York-Pennsylvania boundary line to the head of tidewater at Trenton, New Jersey, and Morrisville, Pennsylvania.

The drainage basin contributary to this zone, excepting part of the Lehigh River Basin, is relatively sparsely inhabited and contains few sewered communities and relatively few industrial establishments producing waste water. The streams draining this area being, in general, relatively clean and of high elevation, are well adapted as sources of public water supplies, after treatment or purification.

The principal uses of the waters of the Delaware River in Zone 1 are expected to be for water supply after such treatment or purification as may be necessary, and for recreation, bathing, maintenance of fish and aquatic life, agriculture, and for other related purposes.

ZONE 2: Zone 2 is that part of the Delaware River extending from the head of tidewater at Trenton, New Jersey and Morrisville, Pennsylvania, to a line drawn perpendicular to the channel of the Delaware River from the mouth of Pennypack Creek in Philadelphia, Pennsylvania, to the corresponding point on the New Jersey shore.

The drainage basin contributary to this zone is somewhat more densely populated than that of Zone 1, and it contains more sewered communities and industrial establishments.

The principal uses of the waters of the Delaware River in Zone 2 are expected to be for water supply, after treatment or purification, and for recreation, navigation, maintenance of fish and aquatic life, agricultural, industrial and other purposes.

ZONE 3: Zone 3 is that part of the Delaware River extending from the aforesaid line connecting the mouth of Pennypack Creek in Philadelphia and the corresponding point in New Jersey to the Pennsylvania-Delaware boundary line.

The drainage basin contributary to this zone contains populous metropolitan areas including Philadelphia, Pennsylvania, and Camden, New Jersey.

The principal uses of the waters of the Delaware River in Zone 3 are expected to be for navigation, industrial water supply, and other purposes.

The water in this zone, however, should be of such sanitary quality that it will not be unfit for use as sources of water supply, will not be harmful to fish life, and will not adversely affect the quality of the waters of the tidal tributaries.

ZONE 4: Zone 4 is that part of the Delaware River extending from the Pennsylvania-Delaware boundary line to the Atlantic Ocean.

The principal uses of the waters of the Delaware River in Zone 4 are expected to be for navigation, industrial water supplies, commercial fishing, shellfish culture, recreation and other purposes.